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(71)Applicant : FUJI XEROX CO LTD

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KASAO ATSUSHI

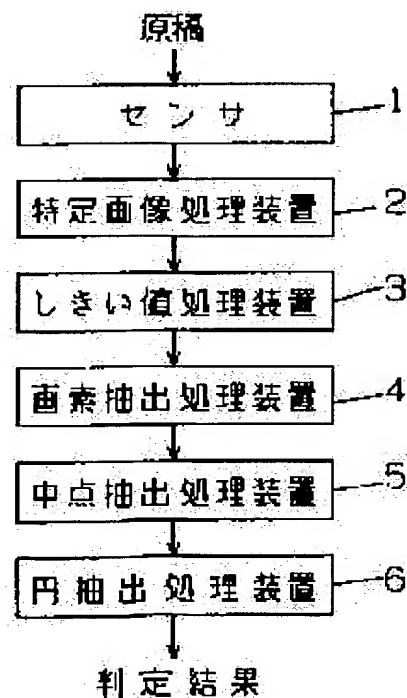
TOHO RYOSUKE

(54) IMAGE PROCESSOR

(57)Abstract:

PURPOSE: To accurately detect image data even when noise is included in the image data.

CONSTITUTION: An original being an object is converted into plural image signals by a sensor 1 and processed to be fitted by every image component by a specified image processor 2. After a threshold processor 3 performs the threshold processing of the image signal processed to be fitted based on one or plural thresholds, the on/off of a picture element is decided by a picture element extraction processor 4. A middle point extraction processor 5 obtains a middle point between two black picture elements in a main scanning direction, detects the coupling of the middle point position in a subscanning direction and calculates a distance from the picture element to the middle point position. A circle extraction processor 6 discriminates a specified circle while accumulating the results by the middle point extraction processor 5 in the subscanning direction. Thus, the circle image is surely detected with



high accuracy and high speed processing is realized because real time processing can be possible.

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CLAIMS

[Claim(s)]

[Claim 1] In the image processing system which outputs by performing an image processing to the manuscript image read per pixel A location calculation means to compute the middle point location of the pixels in a main scanning direction, A distance calculation means to compute the distance from said pixel to a middle point location, and a connective detection means to detect the connectivity of said middle point location in the direction of vertical scanning, The image processing system characterized by having a circle extract means to perform a circle extract based on the connectivity of said middle point location, and the distance from said pixel to a middle point location.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the image processing system for preventing the improper use image processing of the manuscript which carried out special printing, in order to prevent copying faithfully color copies, such as a manuscript for image-processing prevention especially a bill, and negotiable securities.

[0002]

[Description of the Prior Art] In recent years, the need for development of a copying machine of having the function to prevent the copy of negotiable securities, such as a bill or a stock certificate, and a debenture, a commuter pass, the admission ticket of an event thing, a gold note, etc. is high with improvement in the engine performance of a color copying machine. As a technique about the copy prevention function of the conventional copying machine, it roughly divides and is divided into the technique which gives the function which detects a copy prohibition manuscript with the technique, and image reading / detection equipment which gives the function to prevent a normal copy to a manuscript side, and does not carry out copy actuation normally.

[0003] As a function to prevent a normal copy to the former manuscript side For example, the thing in which make a metal powder mix in a manuscript and the copy image based on metal powders other than a manuscript image is made to form by reflection by the metal powder of a manuscript image side exposure lamp, The thing using the fluorescence color as for which clear image formation is not made to the thing or ink into which it was processed using the moire and the holography which are produced by applying a halftone dot at the time of the background pattern of a manuscript record image, and a copy with a copy, Techniques, such as a thing for which the blue ink which is hard to reproduce with the copying machine using a selenium photo conductor is made to use, are known.

[0004] Moreover, the method of processing always [forward] changing the output state of a form which detects a copy prohibition manuscript with latter image reading / detection equipment, and makes the output form which the technique which gives the function which does not carry out copy actuation normally compares the reading data of a manuscript with the master data in memory, judges whether it is the manuscript which may copy, and forbids a copy un-establish etc. is learn.

[0005] Any improper use copy prevention technique of the manuscript of these former had merits and demerits, and the normal copy prevention function by the side of image reading / detection equipment was read with memory with a huge capacity which memorizes the master data of a specific manuscript, and had the problem that the means for a comparative judgment with a manuscript image etc. was required, and cost became high. The technique for solving such a trouble is proposed by JP,4-296323,A. That is, the circular image which consists of spacing of the size of each circle and the line of each circle or two or more concentric circle-like codes of each diameter of circle which specified either at least is printed to a manuscript side, and an improper use image processing is prevented by recognizing this concentric circle-like code with an image processing system.

[0006]

[Problem(s) to be Solved by the Invention] By the way, the circular image for preventing the conventional improper use image processing notes the point that a manuscript can be recognized in any include angles. In case a circle is detected, only the image data on horizontal-scanning Rhine is referred to. However, the noise was contained in the image data inputted from the manuscript, and with the conventional technique, this noise ****(ed) the bad influence and had lowered the precision of circle detection. The purpose of this invention is offering the image processing system which can detect correctly, even if the noise is contained in image data.

[0007]

[Means for Solving the Problem] In the image processing system which this invention indicated by claim 1 performs an image processing to the manuscript image read per pixel, and is outputted in order to attain the above-mentioned purpose A location calculation means to compute the middle point location of the pixels in a main scanning direction, It is in the configuration equipped with a distance calculation means to compute the distance from said pixel to a middle point location, a connective detection means to detect the connectivity of said middle point location in the direction of vertical scanning, and a circle extract means to perform a circle extract based on the connectivity of said middle point location, and the distance from said pixel to a middle point location.

[0008]

[Function] According to the above-mentioned configuration, a circle image is certainly detectable in a high precision by considering as the information for a circle extract in quest of the middle point location of the pixels of a main scanning direction, the distance from this pixel to a middle point location, and the connectivity of the middle point location of the direction of vertical scanning. Moreover, since the real-time operation is possible, high-speed processing can be performed.

[0009]

[Example] A drawing is used for below and the example of this invention is explained to it. Drawing 1 shows the configuration of the whole system of an image processing system. The target manuscript is changed into two or more picture signals by the sensor 1. Processing which suited each image component is performed and each picture signal is inputted into the threshold processor 3 by the specific image processing system 2. The threshold processor 3 performs threshold processing based on one or two or more thresholds. The pixel extract processor 4 judges ON/OFF of a pixel from the result of the threshold processor 3. The middle point extract processor 5 detects the connectivity of said middle point location in the direction of vertical scanning, and computes the distance from said pixel to a middle point location while it asks for the middle point between two black pixels from a main scanning direction. The circle extract processor 6 identifies a specific circle, accumulating the result of the middle point extract processor 5 to the direction of vertical scanning.

[0010] Next, each above-mentioned processing is explained to a detail. The configuration of input process is shown in drawing 2. A manuscript is read by the sensor 1 and processed as two or more image components. Here, the case of three components of RGB is explained. Since there is dotage which generally comes to an input image from optical system, gradation amendment / image enhancement is performed. Since the extract of a characteristic pixel serves as the purpose from reappearance of an image in this processing, the image processing which specialized in the specific color becomes effective. For example, R component obscures in the specific image processing system 2, and G component is that image enhancement and B component process through etc.

[0011] Threshold processing of the data processed by the specific image processing system 2 is carried out by the threshold processor 3, respectively. The threshold processor 3 processes with one or more thresholds. By general threshold processing, it is $THr < Dr$ by thresholds THr , THg , and THb . $THg < Dg$ In $THb < Db$, an output signal is set to ON, respectively. Moreover, two thresholds are prepared by specifying a color component, respectively. $THr1 < Dr < THr2$ $THg1 < Dg < THg2$ In $THb1 < Db < THb2$, an output signal can also be set to ON.

[0012] Further two or more thresholds are used. $THr1 < Dr < THr2$ $THr3 < Dr < THr4$ $THg1 < Dg < THg2$ $THg3 < Dg < THg4$ $THb1 < Db < THb2$ Threshold processing which established the phase like $THb3 < Db < THb4$ can also be performed.

[0013] Although this example explained the output from a sensor as R, G, and B, the signal itself is realizable with a configuration with the same said also of a single (for example, only G component) or plurality. Moreover, the same effectiveness is acquired also by signal [not only like R, G, and B but the luminance signals L, a, and b] whose signal is also.

[0014] The signal by which threshold processing was carried out is sent to the pixel extract processor 4, and performs a pixel extract based on the data from the threshold processor 3 of each signal component. The pixel extract processor 4 is specifying a color, although generally outputted by signal $out=Ro\&Go\&Bo$ as a result of threshold processing. $out=Ro|Go|Bo$ $out=Ro| (Go\&Bo)$

Only a specific color can be extracted by actuation like $out=Ro\&Go\&Bo$. Moreover, the probability of data can also be given by performing not logical operation but arithmetic operation.

[0015] Although drawing 2 is the case where it has every one threshold processor to each picture signal, it thinks, also when it has two or more threshold processors and a pixel extract processor, as shown in drawing 3 . With the configuration shown in drawing 3 , since a pixel extract can be carried out for every color, even when a color is mottled, it can extract correctly.

[0016] The concept of a circle extract is explained using drawing 4 . The description [as opposed to / that, as for a circle, a manuscript is placed how / a main scanning direction as like] does not change. Here, scanning to a main scanning direction, the seating rim (black pixel) of a circle is extracted and the case where it asks for the middle point between black pixels is assumed. If this is continuously processed to the direction of vertical scanning, with a circle, the middle point will serve as a straight line to the direction of vertical scanning, and the die length will become equal to the maximum (diameter) of horizontal-scanning lay length. A circle is extracted using these descriptions.

[0017] Next, the extract technique of the middle point and the extract technique of the circle mainly concerned with detection of the continuity of the middle point to the direction of vertical scanning are explained. Drawing 5 is the explanatory view of the middle point detection approach. The thing of illustration is a general example, when there are four black pixel lumps in a main scanning direction, L1, L2, and L3 are measured, respectively, and middle point information is also measured by coincidence. The technique of being to the base of middle point detection using drawing 6 is explained. As a seating rim of a circle, the point which becomes a white pixel from a black pixel is detected (S1), and let it be a start point. A counter is turned ON with detection of a start point (S2). And the pixel which turns into a black pixel from the white pixel used as an ending point is detected (S3), and even the pixel concerned is counted (S4). A counter is reset after a counter output (S5). Since the middle point serves as half [of counted value], it can ask also for the location of the middle point immediately by adding a binary counter. This configuration is an effective method when a noise does not exist in the target image.

[0018] On the other hand, the case where a noise is taken into consideration is explained. Drawing 7 shows the case where a noise exists in a circle. Since a noise exists, it will be divided by L1 and L2 and it becomes impossible to extract the exact middle point of a circle, although the die length which crosses a circle is L3 in practice. However, if it asks for the middle point between all the black pixels to a main scanning direction in order to cope with a noise, as shown in drawing 8 , when the middle points increase in number, a real-time operation will become difficult. Moreover, the hardware cost for middle point processing will also go up, and implementability/engine performance will be affected in a circle extract. Thus, although it is difficult to solve the technical problem that the middle point is extracted correctly, by processing of only a main scanning direction when there is a noise, correspondence becomes possible by using together the description over the direction of vertical scanning of a circle.

[0019] Next, the technique of middle point processing is explained. each of the distance th1-th5 at the time of scanning drawing 9 in the direction of a raster to a circle, three square shapes, and four square shapes -- the situation of the middle point is shown. In this case, if all become a straight line and discriminate from a circle only now, misconception will arise. Here, before extracting the middle point, the distance information on the middle point of Rhine in front of one is used. in the case of a circle, it is alike, and it follows and the last whose first distance progresses in the direction of vertical scanning which is about zero and which decreases gradually becomes about zero shortly bordering on a certain fixed value (diameter) which increases gradually -- a property [like] is shown. On the other hand, in the

case of three square shapes, it only increases gradually, and four square shapes only show constant value. Since three square shapes and four square shapes are not necessarily inputted in such a location, in practice more complicated situation is shown. In order that a circle may show the same property according to any physical relationship to it, it asks for the middle point, using this property. Therefore, it can process with a circle, limiting the target point. The block diagram in that case is shown in drawing 10. In addition, detection of a start point, an ending point, and the middle point is the same as that of drawing 6.

[0020] A circle is scanned, a pixel is extracted (S10), a start point is detected (S11), and the start point concerned is memorized (S12). An ending point is detected and (S13) memorized similarly (S14). The middle point is detected from the memorized start point and an ending point (S15), and the distance of this middle point pixel and the near middle point pixel in front of one line is compared (S16). The description of a circle is judged from a comparison result (S17), when there is the description of a circle, the detected middle point is memorized (S18), and when there is no description of a circle, the storage which repeats the detected middle point is performed (S19). And return and the data based on degree scan are processed to step 11.

[0021] Although processed to the whole circle, as it is shown in drawing 11 (a), only for a field, a circle is [old processing] a part. Moreover, as shown in drawing 11 (b), the direction of vertical scanning is not interfered even if discontinuous. As mentioned above, although the middle point detection method using the information on the direction of vertical scanning was explained, if the above processings are performed, as a processing result is shown in drawing 12, the middle point will serve as a straight line. In addition to this condition, it can judge whether it is a circle by distinguishing whether the linear die length is equal to a diameter of circle.

[0022] Here, the case where it realizes by the memory for one line is explained as one example of the circle extract approach. The concept of processing is shown in drawing 13. A flow is shown in drawing 14. In addition, its attention is paid to the pixel detected as the middle point here using the technique explained about the extract technique of the middle point until now. Black, in the case of a black pixel, the same pixel (near) of front Rhine also adds [a view pixel] (+1). By this processing, the die length of the straight line of a lengthwise direction is memorized by memory. When a view pixel is [the same pixel (near) of front Rhine] a black pixel in white, an old memory value is investigated, and when close to the die length of the diameter memorized beforehand, it judges as a circle candidate. The value of memory is cleared when that is not right. A circle candidate can be judged by the above processing. The example of illustration shows that the number of pixels of the middle point is "46."

[0023] In drawing 14, if the pixel of the middle point is detected by a certain Rhine scan (S20), when the detected pixel is a white pixel, it distinguishes whether the same pixel of front Rhine is black (S21), and in order to detect the following pixel, it will return to step 20 similarly at the time of white. On the other hand, when the same pixel of front Rhine is black, it judges whether middle point length and a threshold are equal (S22), and when not equal, it returns to step 20. Moreover, when middle point length is equal to a threshold, as a circle candidate, a circle candidate signal is outputted (S23) and the next pixel detection is performed. If it returns to beginning and a black pixel is detected at step 20, it will distinguish whether the same pixel of front Rhine is black (S24). When the same pixel of front Rhine is black, the number of pixels is added (S25), and it returns from this distinction result to step 20 as setting the number of pixels to "1" (S26) at the time of white.

[0024] Application 1: When two or more circles are in the candidate for discernment, as shown in drawing 15, explain the extract technique in case two or more circles are in a manuscript. In order to judge whether it is a copy prohibition manuscript using two or more information, dependability improves. Moreover, it also becomes possible by asking for the arrangement relation of two or more circles, and magnitude to give information. In drawing 16, discernment of a circle uses the means (circle detection processor) stated in the above-mentioned example. The circle detection processor 10 detects the information on a circle, for example, a main location, a diameter, etc., and sends ***** of two or more yen of the circle to the detection processor 11. Based on the information on a circle, a detection processor judges synthetically the arrangement relation / magnitude / number of a circle of two

or more yen, and the result is outputted when the arrangement relation is judged to be the thing of the ban on a copy.

[0025] Application 2: Since information increases by adding a specific color to a circle as shown in drawing 17 when a part of line which a circle constitutes is colored [specific], the dependability of a circle extract improves. Moreover, the merit which can also detect the inclination of a manuscript is also in coincidence. The basic technique of a circle extract processor uses this example. In drawing 18 , the picture signal outputted from the sensor 1 is sent to the specific color detection processor 7, and as compared with the color memorized beforehand, when a specific color is matched, it sends the signal to the circle extract processor 6. When either of the pixels of both ends for the pixel judged to be a specific color to ask for the middle point of a circle is matched, the location where the specific color appeared is memorized. Since the specific color is beforehand added to the circle which should be extracted, it is judged with a circle, and only when judged with the specific color having been added further by middle point information, it judges with this circle being a circle which should be extracted using it. When judged with a circle by the circle extract processor 6, the information on the location of the core of a circle and a specific color is outputted. As information on a specific color, combination, such as a color, an absolute location, a relative position, and an include angle from a core, can be considered.

Application 3: When the line which a circle constitutes is colored [specific], as shown in drawing 19 , color the line which constitutes a circle in a specific color. To what kind of color scheme a color scheme is carried out, as long as it has semantics and the regulation is followed, when it decomposes into the histogram of each color has a degree of freedom. Since information increases, the dependability of a circle extract improves.

[0026] The basic technique of a circle extract uses this example. However, in drawing 20 , the diameter-of-circle extent buffer memory (Rhine memory) 12 is needed in the direction of vertical scanning for histogram calculation. When extracted by the circle detection processor 10 with a circle candidate, the histogram of the field concerned is computed by using the binary image of the circle as a mask image with the histogram calculation processor 13. When in agreement with the pattern which the distribution condition of a histogram was sent to the judgment processor 14, and was memorized beforehand, the circle judges with it being the circle of a specific image. When circle detection is carried out, the histogram of each color of a circle is investigated, and only when the same as that of what is memorized beforehand, it judges with it being a predetermined circle. Since discernment becomes two steps, misconception can be lessened. Moreover, by memorizing two or more histogram information, it also becomes possible to embed other information. Although it asked for the histogram in RGB space in this explanation, it does not interfere, even if it uses other color spaces.

[0027]

[Effect of the Invention] Since the direction connectivity of vertical scanning of the pixel period point location computed only not only in the image data on horizontal-scanning Rhine is also referred to according to this invention an above-mentioned passage, even if the noise is contained in image data, it becomes possible to detect a circle correctly.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is drawing showing the whole configuration.

[Drawing 2] It is drawing showing the detailed configuration of input process.

[Drawing 3] It is drawing showing the configuration of pixel extract processing.

[Drawing 4] It is drawing showing the concept of circle detection.

[Drawing 5] It is drawing explaining the detection technique of the middle point.

[Drawing 6] It is the block diagram of middle point detection.

[Drawing 7] It is drawing explaining middle point detection when a noise exists.

[Drawing 8] It is drawing showing the result of middle point detection when a noise exists.

[Drawing 9] It is drawing showing the property of the middle point of a circle.

[Drawing 10] It is drawing showing the configuration of the middle point detection technique in which the information on the direction of vertical scanning was used.

[Drawing 11] It is drawing explaining other technique of middle point detection.

[Drawing 12] It is drawing explaining the concept of circle detection.

[Drawing 13] It is drawing explaining circle detection.

[Drawing 14] It is drawing showing processing of circle detection.

[Drawing 15] It is drawing explaining the case where there are two or more circles.

[Drawing 16] It is drawing showing the configuration of circle detection in case there are two or more circles.

[Drawing 17] It is drawing explaining the case where a specific color is attached to a part of circle.

[Drawing 18] It is drawing showing the configuration of a circle extract when a specific color is attached to a part of circle.

[Drawing 19] It is drawing explaining the case where a circle is colored with a specific histogram.

[Drawing 20] It is drawing showing the configuration of the circle detection at the time of coloring a circle with a specific histogram.

[Description of Notations]

1 [-- A pixel extract processor 5 / -- A middle point extract processor, 6 / -- A circle extract processor, 7 / -- A specific color detection processor, 10 / -- A circle detection processor, 11 / -- It is a circle detection processor and 12 two or more. / -- The Rhine memory, 13 / -- A histogram calculation processor, 14 / -- Judgment processor] -- A sensor, 2 -- A specific image processing system, 3 -- A threshold processor, 4

[Translation done.]

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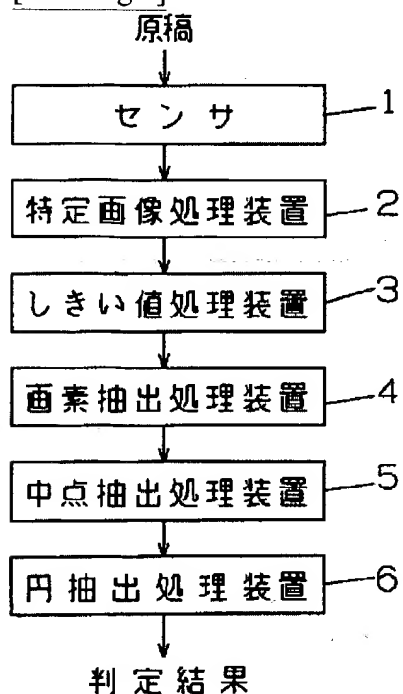
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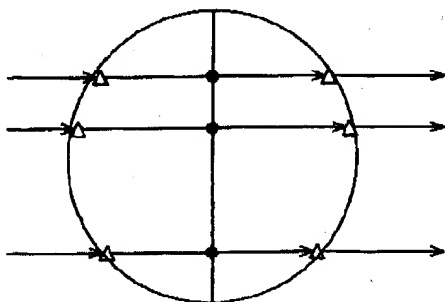
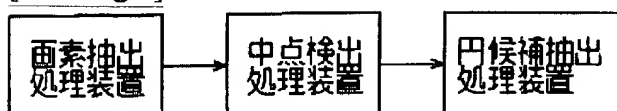
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DRAWINGS

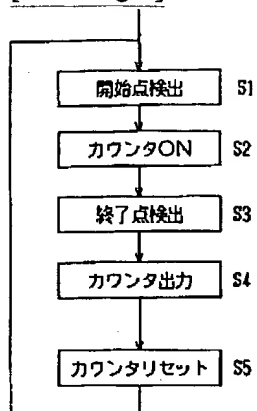
[Drawing 1]



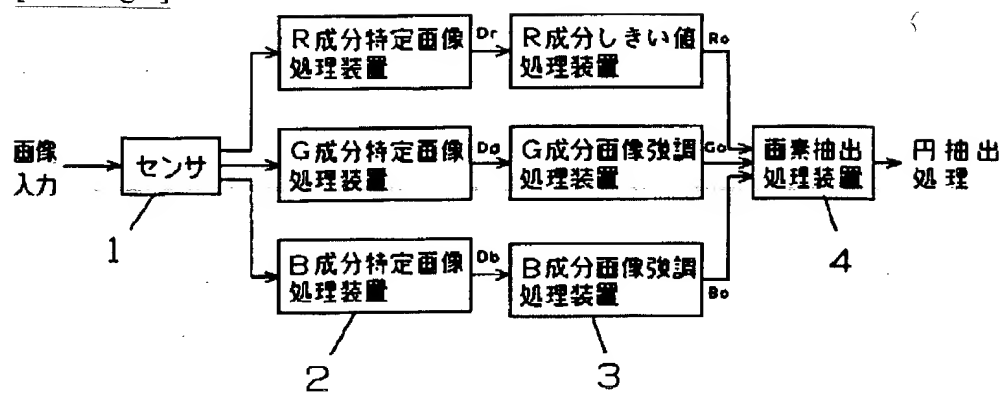
[Drawing 4]



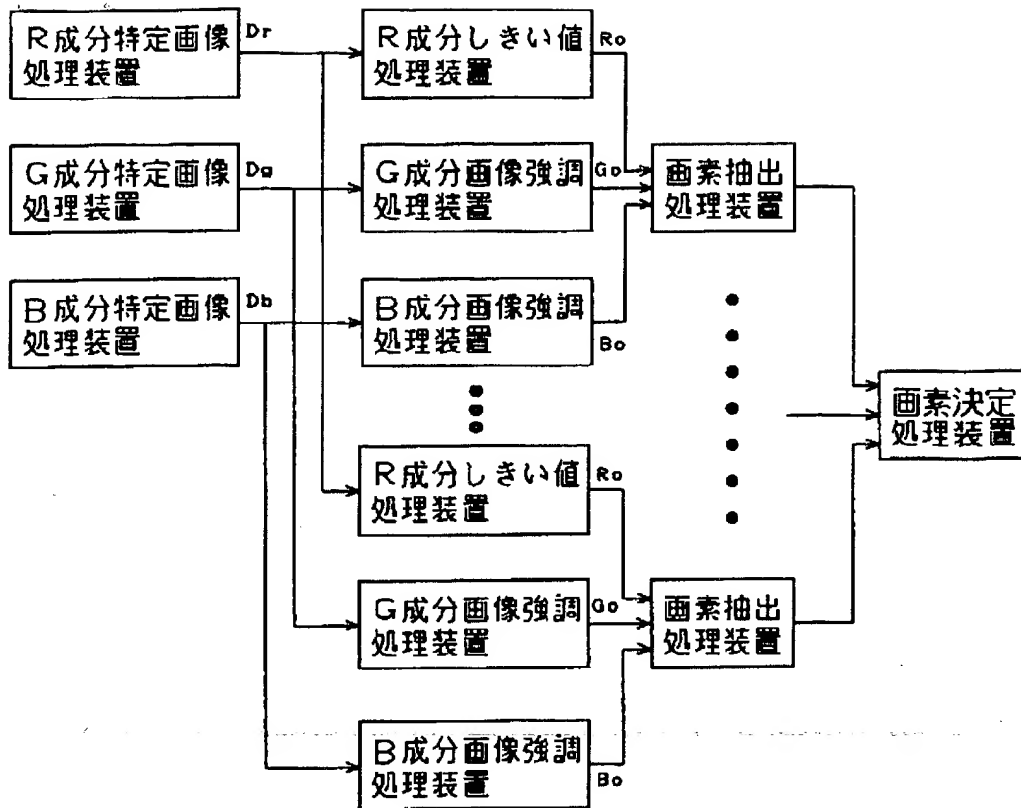
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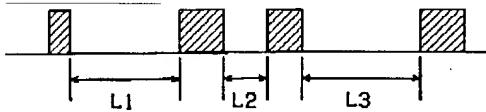
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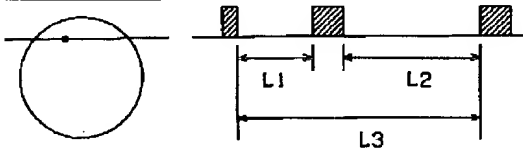
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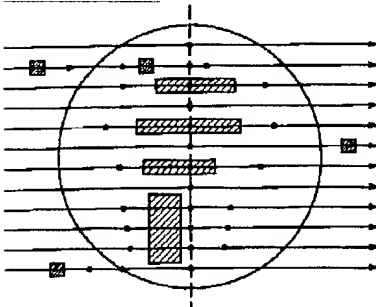
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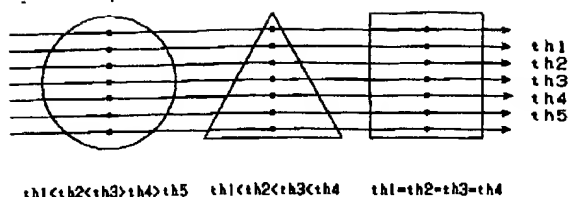
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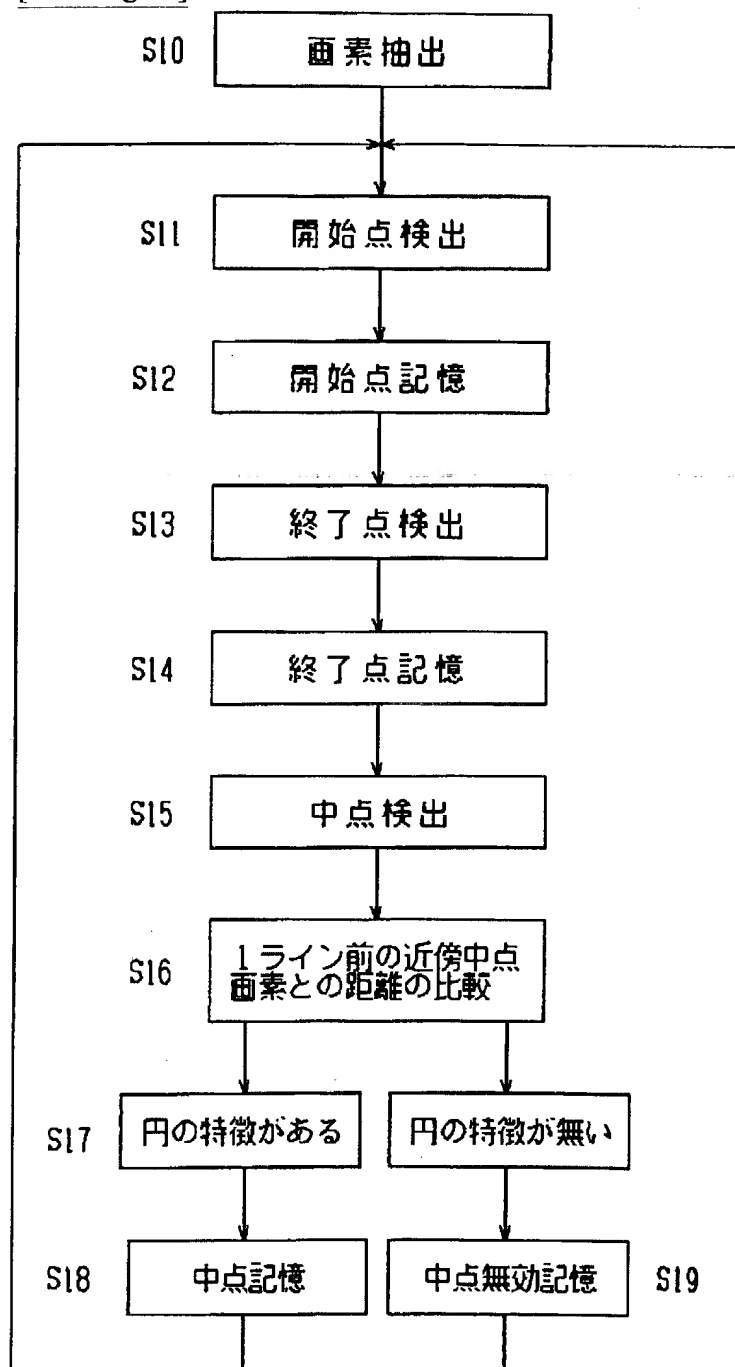
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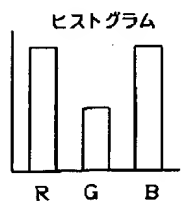
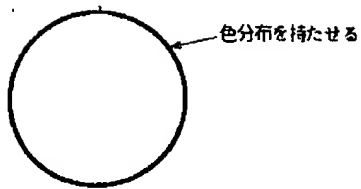
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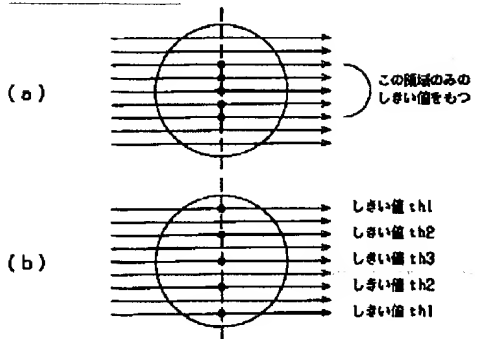
[Drawing 10]



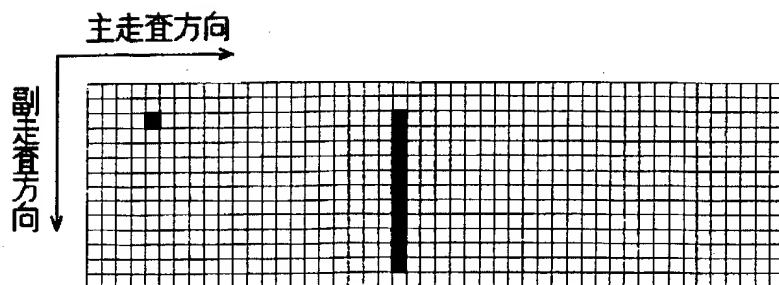
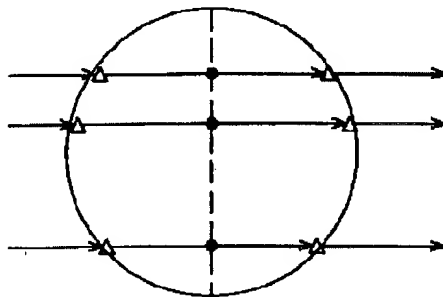
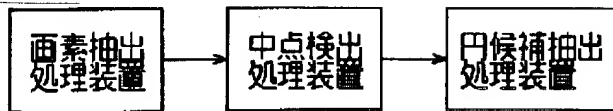
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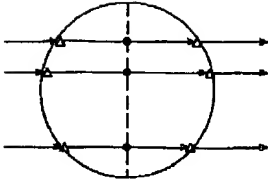
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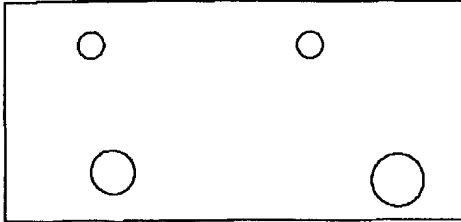
[Drawing 12]



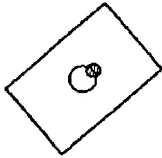
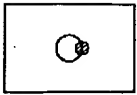
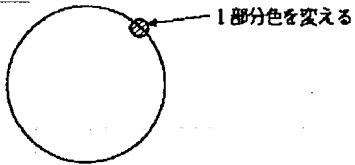
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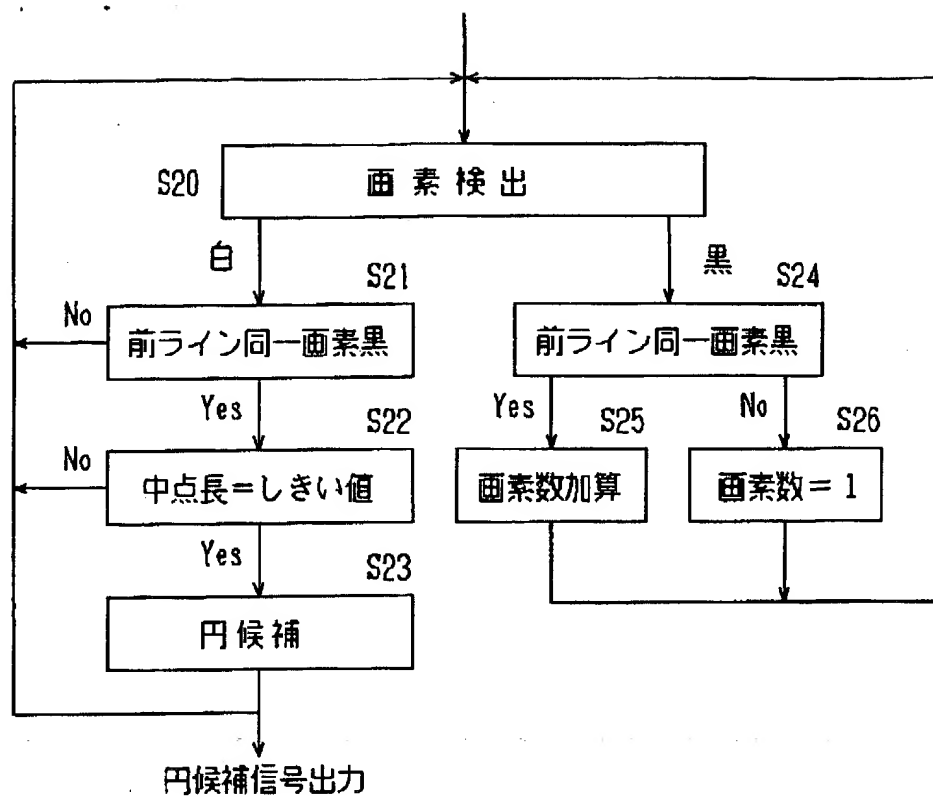
[Drawing 15]



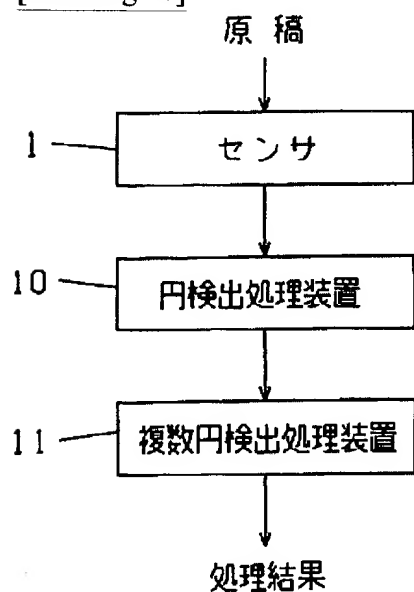
[Drawing 17]



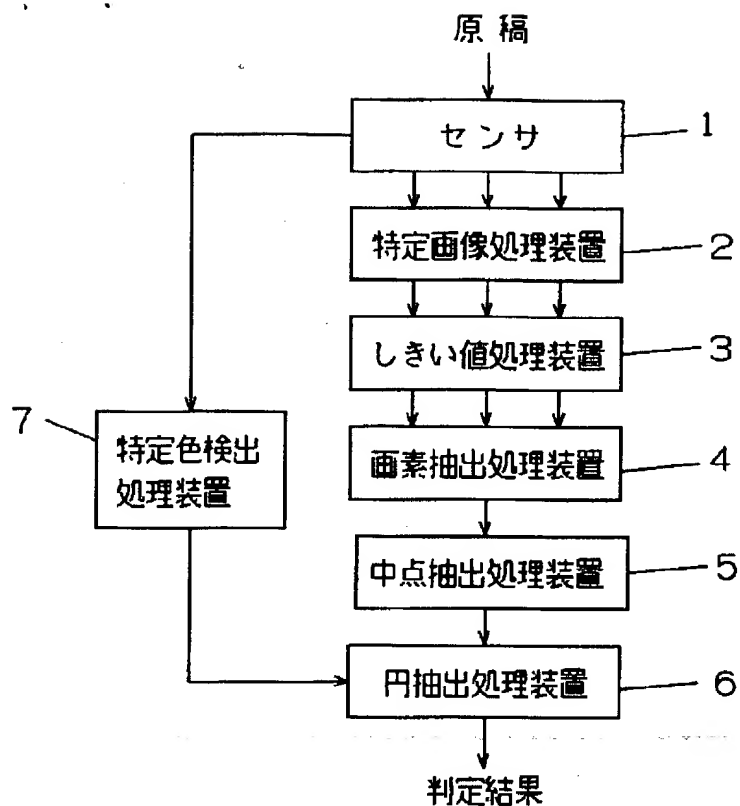
[Drawing 14]



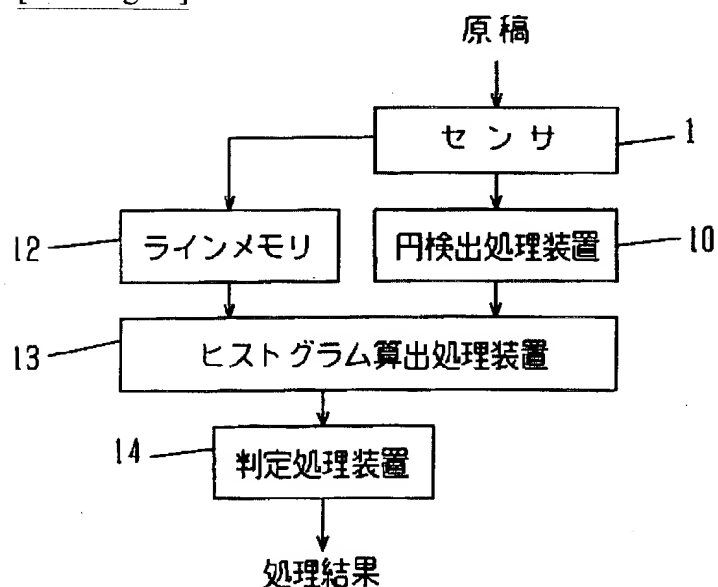
[Drawing 16]



[Drawing 18]



[Drawing 20]



[Translation done.]

NOTICES

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
 [Section partition] The 2nd partition of the 6th section
 [Publication date] September 26, Heisei 13 (2001. 9.26)

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 // H04N 1/387
 1/40

[FI]

G03G 21/00 550
 B42D 15/10 531 C
 G03G 15/22 105 Z
 H04N 1/387
 G06F 15/62 410 Z
 H04N 1/40 Z

[Procedure revision]

[Filing Date] November 21, Heisei 12 (2000. 11.21)

[Procedure amendment 1]

[Document to be Amended] Specification

[Item(s) to be Amended] Claim

[Method of Amendment] Modification

[Proposed Amendment]

[Claim(s)]

[Claim 1] The pixel extract processor which performs the pixel extract of the specific color to a manuscript image about two or more colors of each,

It has the pixel decision processor which determines the pixel for the processing which judges whether it is a copy prohibition manuscript in response to the extract result about two or more colors in the pixel extract processor concerned,

The image processing system with which said manuscript image judges whether it is a copy prohibition

manuscript based on the pixel determined with the pixel decision processor concerned.

[Claim 2] The pixel extract processor which performs the pixel extract of the specific color to a manuscript image about two or more colors of each,

The pixel decision processor which determines the pixel for a circle extract in response to the extract result about two or more colors in the pixel extract processor concerned,

The image processing system which has the circle extract processor which extracts the specific circular image in said manuscript image based on the pixel determined with the pixel decision processor concerned.

[Procedure amendment 2]

[Document to be Amended] Specification

[Item(s) to be Amended] 0007

[Method of Amendment] Modification

[Proposed Amendment]

[0007]

[Means for Solving the Problem] In order to make the above-mentioned purpose attain, the image processing system concerning invention of claim 1 The pixel extract processor which performs the pixel extract of the specific color to a manuscript image about two or more colors of each, It has the pixel decision processor which determines the pixel for the processing which judges whether it is a copy prohibition manuscript in response to the extract result about two or more colors in the pixel extract processor concerned, and said manuscript image is in the configuration which judges whether it is a copy prohibition manuscript based on the pixel determined with the pixel decision processor concerned. The image processing system concerning invention of claim 2 is in the configuration which has the pixel extract processor which performs the pixel extract of the specific color to a manuscript image about two or more colors of each, the pixel decision processor which determines the pixel for a circle extract in response to the extract result about two or more colors in the pixel extract processor concerned, and the circle extract processor which extract the specific circular image in said manuscript image based on the pixel determined with the pixel decision processor concerned.

[Procedure amendment 3]

[Document to be Amended] Specification

[Item(s) to be Amended] 0008

[Method of Amendment] Modification

[Proposed Amendment]

[0008]

[Function] According to this invention, since a pixel extract can be carried out for every color, even when a color is mottled, it can extract correctly.

[Procedure amendment 4]

[Document to be Amended] Specification

[Item(s) to be Amended] 0027

[Method of Amendment] Modification

[Proposed Amendment]

[0027]

[Effect of the Invention] Since according to invention of claim 1 it can extract correctly even when a color is mottled by carrying out a pixel extract for every color, the judgment of an exact copy prohibition manuscript is attained. Moreover, in order according to invention of claim 2 to perform the pixel extract of a specific color about two or more colors of each and to determine a pixel from two or more of these extract results, a circle image is detectable in a high precision, and even when a color is mottled, it is not necessary to make the configuration of a circle extract processor large-scale.

[Translation done.]